

WHAT IS CLAIMED IS:

1. A sub-network of an optical communication network, the sub-network comprising:
 - 5 four nodes each having two input ports and two output ports;
 - 10 a first one of the nodes having the input ports and one of the output ports coupled to other ones of the nodes, and wherein the other output port of the first node is operable to send signals outside of the sub-network;
 - 15 a second one of the nodes having the output ports and one of the input ports coupled to other ones of the nodes, and wherein the other input port of the second node is operable to receive signals from outside of the sub-network;
 - 20 a third one of the nodes having the output ports and one of the input ports coupled to other ones of the nodes, and wherein the other input port of the third node is operable to receive signals from outside of the sub-network; and
 - 25 a fourth one of the nodes having the input ports and one of the output ports coupled to other ones of the nodes, and wherein the other output port of the fourth node is operable to send signals outside of the sub-network.
2. The sub-network of Claim 1, wherein:
 - one of the output ports of the first node couples to one of the input ports of the fourth node;
 - 15 one of the output ports of the second node couples to one of the input ports of the first node and the other of the output ports of the second node couples to one of the input ports of the fourth node;
 - 20 one of the output ports of the third node couples to one of the input ports of the first node and the other of the output ports of the third node couples to one of the input ports of the second node; and
 - 25 one of the output ports of the fourth node couples to one of the input ports of the second node.

3. The sub-network of Claim 1, wherein one of the output ports of the first node couples to a second sub-network and one of the input ports of the second node couples to the second sub-network, the second sub-network comprising:

four nodes each having two input ports and two output ports;

5 a first one of the nodes having the input ports and one of the output ports coupled to other ones of the nodes, and wherein the other output port of the first node is operable to send signals outside of the sub-network;

10 a second one of the nodes having the output ports and one of the input ports coupled to other ones of the nodes, and wherein the other input port of the second node is operable to receive signals from outside of the sub-network;

a third one of the nodes having the output ports and one of the input ports coupled to other ones of the nodes, and wherein the other input port of the third node is operable to receive signals from outside of the sub-network; and

15 a fourth one of the nodes having the input ports and one of the output ports coupled to other ones of the nodes, and wherein the other output port of the fourth node is operable to send signals outside of the sub-network.

4. The sub-network of Claim 3, wherein:

20 the other output port of the fourth node of the sub-network couples to the other input port of the second node of the second sub-network; and

the other output port of the first node of the second sub-network couples to the other input port of the third node of the sub-network.

5. The sub-network of Claim 1, wherein each of the nodes is operable to:

25 receive a packet comprising a destination address;

determine an output port from the sub-network based on the destination address; and

route the packet to one of the first node and the fourth node corresponding to the determined output port.

6. The sub-network of Claim 5, wherein each of the nodes is further operable to determine the output port based on the total number of sub-networks forming a communication network, the output port selected to minimize the number of intermediate sub-networks to reach the destination address.

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7. The sub-network of Claim 1, wherein each of the nodes further comprises an add/drop module operable to:

couple to add/drop lines;

route communications from the input ports of the node to an add/drop line;

10 and

route communications from an add/drop line to the output ports of the node.

8. A communication network comprising a plurality of sub-networks, each sub-network comprising:

four nodes each having two input ports and two output ports;

5 a first one of the nodes having the input ports and one of the output ports coupled to other ones of the nodes in the sub-network, and wherein the other output port of the first node couples to another one of the sub-networks;

a second one of the nodes having the output ports and one of the input ports coupled to other ones of the nodes in the sub-network, and wherein the other input port of the second node couples to another one of the sub-networks;

10 a third one of the nodes having the output ports and one of the input ports coupled to other ones of the nodes in the sub-network, and wherein the other input port of the third node couples to another one of the sub-networks; and

15 a fourth one of the nodes having the input ports and one of the output ports coupled to other ones of the nodes in the sub-network, and wherein the other output port of the fourth node couples to another one of the sub-networks.

9. The network of Claim 8, wherein, within each sub-network:

one of the output ports of the first node couples to one of the input ports of the fourth node;

20 one of the output ports of the second node couples to one of the input ports of the first node and the other of the output ports of the second node couples to one of the input ports of the fourth node;

25 one of the output ports of the third node couples to one of the input ports of the first node and the other of the output ports of the third node couples to one of the input ports of the second node; and

one of the output ports of the fourth node couples to one of the input ports of the second node.

10. The network of Claim 8, wherein, within each sub-network:
the other output port of the first node couples to the other input port of the
third node of a first other one of the sub-networks; and
the other output port of the fourth node couples to the other input port of the
5 second node of a second other one of the sub-networks.

11. The network of Claim 10, wherein, within each sub-network:
the other input port of the second node couples to the other output port of the
fourth node of the first other sub-network; and
10 the other input port of the third node couples to the other input port of the first
node of the second other sub-network.

12. The network of Claim 8, wherein each of the nodes is operable to:
receive a packet comprising a destination address;
15 determine an output port from the sub-network based on the destination
address; and
route the packet to one of the first node and the fourth node corresponding to
the determined output port.

- 20 13. The network of Claim 12, wherein each of the nodes is further
operable to determine the output port based on the total number of sub-networks
forming the communication network, the output port selected to minimize the number
of intermediate sub-networks to reach the destination address.

- 25 14. The network of Claim 8, wherein, within each sub-network, each of the
nodes further comprises an add/drop module operable to:
couple to add/drop lines;
route communications from the input ports of the node to an add/drop line;
and
30 route communications from an add/drop line to the output ports of the node.

15. A sub-network of an optical communication network, the sub-network comprising:

a first node, a second node, a third node, and a fourth node interconnected to form a first unidirectional communication ring with direct communications links from 5 the fourth node to the third node, the third node to the second node, the second node to the first node, and the first node to the fourth node;

the second node further connected to the fourth node to form a second unidirectional communication ring with direct communications links from the second node to the fourth node, the fourth node to the third node, and the third node to the 10 second node; and

the third node further connected to the first node to form a third unidirectional communication ring with direct communications links from the third node to the first node, the first node to the fourth node, and the fourth node to the third node.

15 16. The sub-network of Claim 15, wherein the direct communications links from one node to an other node are formed by coupling an output port of the one node to an input port of the other node.

17. The sub-network of Claim 15, wherein:

20 the first node is further connected to the third node to form a fourth unidirectional communication ring with direct communications links from the first node to the third node, the third node to the second node, and the second node to the first node; and

25 the fourth node is further connected to the first node to form a fifth unidirectional communication ring with direct communications links from the fourth node to the second node, the second node to the first node, and the first node to the fourth node.

18. The sub-network of Claim 15, wherein:
- an output port of the first node couples to an input port of a node in another sub-network;
- an input port of the second node couples to an output port of a node in another 5 sub-network
- an input port of the third node couples to an output port of a node in another sub-network; and
- an output port of the fourth node couples to an input port of a node in another sub-network.
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19. The sub-network of Claim 15, wherein:
- an output port of the first node couples to an input port of a node in a second sub-network;
- an input port of the second node couples to an output port of a node in the 15 second sub-network
- an input port of the third node couples to an output port of a node in a third sub-network; and
- an output port of the fourth node couples to an input port of a node in the third sub-network.
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20. The sub-network of Claim 19, wherein each of the first node, the second node, the third node, and the fourth node is operable to:
- receive a packet with a destination address indicating a node external to the sub-network; and
- 25 determine a selected output port chosen from the output port of the first node and the output port of the fourth node, the selected output port chosen to minimize the number of intermediate sub-networks between the selected output port and the external node indicated by the destination address.